**S. A. Pikin.** *New Electromechanical Effects in Liquid Crystals.* A fundamental property of the liquid crystal that distinguishes the mesophase from the isotropical liquid is the existence of an orientational degree of freedom ("director") $\mathbf{n}$, which characterizes the macroscopic ordering of the long axes of the molecules in space. This additional degree of freedom of the anisotropic liquid is responsible for the unique properties of the mesophase, which are attributable to the high sensitivity of spatial orientation $\mathbf{n}(\mathbf{r})$ to external factors (electric and magnetic fields, flow velocity fields, etc.). The general theory of instability of the homogeneous $\mathbf{n}(\mathbf{r})$ distribution that appears under the action of the electric field[1,2] adequately describes the multiparameter experimental data of[3,4] and yields concrete recommendations for the creation of liquid-crystal materials for light-valving devices with optimum threshold characteristics.

New types of instabilities have been predicted theoretically and observed experimentally in the mesophases, including azimuthal electrohydrodynamic instability and instability of the plane-parallel flow of nonmagnetic and smectic liquid crystals with inclined orientation of $\mathbf{n}(\mathbf{r})$ on the boundary surfaces,[5,6] and nonlinear orientational instability of the plane-parallel flow of the nematic mesophase.[7] The calculated and measured critical flow velocities $v_c$, above which nonstationary motion of the director (orientational turbulence) appears in the layer of liquid crystal, have a singular dependence on the temperature $T$:

$$v \sim (T_0 - T)^{-1/2}, \qquad T < T_0,$$

where $T_0$ is the point of sign change of the specific shear viscosity of the mesophase.

The new types of instabilities make it possible to explain the above-threshold behavior of liquid crystals both under stationary-perturbation conditions and in the "dynamic dispersion" (turbulence) regime, which arises at electric field strengths near the threshold of stationary electrohydrodynamic instability.

The specific piezoelectric properties of the mesophase are an essential factor in the destabilization of liquid-crystal structure and may also lead to the appearance of ferroelectric ordering in an isotropic liquid. The ferroelectric polarization appears as a result of orientational deformation of molecular groupings, giving rise to a phenomenon of pseudointrinsic ferroelectricity. Generally, such ferroelectrics have a layered (helicoidal) structure, the possibility of whose formation in crystals with finite symmetry groups (when the Lifshitz invariant exists) was first indicated by V. L. Indenbom (Kristallografiya **5**, 115 (1960) [Sov. Phys. Crystallogr. **5**, 106 (1960)]. Group-theoretical analysis of the possible transitions from a smectic phase *A* with the limiting symmetry group $D_\infty$ has shown that the appearance of pseudointrinsic ferroelectricity is due to a second-order $D_\infty \to C_2$ phase transition in the two-dimensional vector representation $E_1$, whose antisymmetric square contains the one-dimensional vector representation $A_2$ ($\{E_1^2\} = A_2$, i.e., the Lifshitz invariant exists). It has been shown that an existing cholesteric phase cannot be a pseudointrinsic ferroelectric. Theoretical estimates of the spontaneous polarization in a liquid crystalline ferroelectric agree with known experimental data.


[1]S. A. Pikin, Zh. Eksp. Teor. Fiz. **60**, 1185 (1971) [Sov. Phys. JETP **33**, 641 (1971)].

[2]S. A. Pikin and A. A. Shtol'berg, Kristallografiya **18**, 445 (1973) [Sov. Phys. Crystallogr. **18**, 283 (1973)].

[3]M. A. Barnik, L. M. Blinov, M. F. Grebenkin, S. A. Pikin, and V. G. Chigrinov, Phys. Lett. **A51**, 175 (1975).

[4]M. I. Barnik, L. M. Blinov, M. F. Grebenkin, S. A. Pikin, and V. G. Chigrinov, Zh. Eksp. Teor. Fiz. **69**, 1080 (1975) [Sov. Phys. JETP **42**, 550 (1975)].

[5]S. A. Pikin and V. L. Indenbom, Kristallografiya **20**, 1127 (1975) [Sov. Phys. Crystallogr. **20**, 687 (1975)].

[6]S. Pikin, G. Ryschenkow, and W. Urbach, J. de Phys. **37**, 241 (1976).

[7]S. A. Pikin, Zh. Eksp. Teor. Fiz. **65**, 2495 (1973) [Sov. Phys. JETP **38**, 1246 (1974)].